Hi. This tutorial covers sample statistics and population parameters.

All right, so when performing inferential statistics, information from a sample is used to make a judgment about a population. So with inferential statistics, we're going from sample to population. To reach this goal, we must take a sample and calculate some statistics. A sample statistic is often used to estimate a population parameter. So we're going to use a sample statistic to make an estimate about a population parameter. So let's define both of those two terms.

A sample statistic is a measure of an attribute of a sample, and a population parameter is a measure of an attribute of a population. So statistic always goes with sample, parameter always goes with population. Population parameters often cannot be calculated due to the large size of the population. So many times, a population parameter will not be able to be calculated directly, but will need to be estimated. And the most common way of estimating it is by using the corresponding sample statistic.

So an example of a sample statistic is a sample mean, and an example of a population parameter is a population mean. So again, we would be using a sample mean to make an estimate of a population mean.

And then to define those two terms, a sample mean is the sum of a certain attribute of a sample divided by the sample size-- abbreviated x bar. And a population is a sum of a certain attribute of a population divided by the population size-- abbreviated mu. So many times, to estimate mu-- because a lot of times, you're not going to be able to calculate mu directly-- we're going to use x bar. So x bar will be able to be calculated, mu generally will not be.

All right, so if you take a look at this chart, what I have here is name of measure, symbol for the sample statistic, and the symbol for the population parameter. So we've already discussed the sample mean and the population mean, but we can also look at a standard deviation and a proportion.

So the symbol for a sample statistic is s with a subscript x. Sometimes this will also just be used as just lowercase s. So s sub x or just s. And then the corresponding population parameter-- so this would be your population standard deviation-- is the Greek letter sigma. So many times, we're going to use s to estimate sigma.

Now if we're looking for a proportion, a sample proportion is abbreviated p hat, so p with the little had on it. And many times, we're going to use p hat to make an estimate of p. p represents your population proportion. So again, x bar estimates mu, s sub x estimates sigma, p hat estimates p.

All right, so let's take a look at a couple examples of sample statistics, and then we'll also look at some corresponding population parameters. So if we look at number one, the average weight of 100 randomly selected adult males. So since here we're looking at a sample of 100 adult males and then calculating the average weight, this would be x bar.

All right, if we look at the proportion of illegal drug users in a sample of 50 local prisoners, here we're looking for a sample proportion. So in this case, we're going to use the symbol p hat.

And the standard deviation of the winnings of the next 20 pulls of a slot machine-- here, again, we're looking at a sample. Since we're only doing the next 20, not a population of pulls, just 20 pulls, here we're looking for a sample standard deviation. So here we'll use the symbol s sub x. So again, the sample statistics here- x bar, p hat, s sub x.

Now if we look at some examples of population parameters, here we're looking for the average weight of adult males. So here our population is adult males. So we're not looking at just the sample, we're looking at now at the population.

So if we're looking for the average or the mean weight, this is a sample mean. So we're going to use the symbol mu.

If we're looking now at number two, the true percentage of illegal drug users among state prisoners, our population here would be state prisoners. And if we're calculating a percentage or a proportion, we're going to use the symbol p.

And if we want the standard deviation of the population of winnings on a slot machine, now we're looking for a population standard deviation. We use that Greek letter sigma.

Now making estimates of population parameters using sample statistics usually requires the use of sampling distributions. So we're going to just review this concept of a sampling distribution. So sampling distribution is defined as a distribution formed by considering the value of the sample statistic for every possible different sample of a given size from a population.

So if we look at a real simple example, let's consider a population to be 1, 2, 3. And then what we're going to assume is that we're going to sample without replacement, we're going to take samples of size 2 and we're not going to let the-- the order of sampling won't matter. So a 1 and a 2 will be the same has a 2 and a 1. So if we look at every possible different sample, our samples would be 1 and 2, 1 and 3, and 2 and 3. So these, again, would be every possible different sample of size n equals 2-- a sample size of 2.

Now in order to make a sampling distribution, we need a sample statistic. So in this case, let's do the sampling distribution of sample means. So if we look here, from this sample 1, 2-- our sample mean x bar-- 1 plus 2 divided by 2 would be 3 divided by 2, or 1.5. 1 and 3 would have a sample mean of 2, and 2 and 3 would have a sample mean of 2.5. So this would represent all of the different sample means of every possible different sample of size n equals 2.

Now if we put that into a distribution, I'd probably use a dot plot. So we'll number our dot plot 1, 2, 3. And then we'll display-- this will be my x bar axis. This will represent all of the sample means. And I would have a sample mean at 1.5, one at 2, and one at 2.5. So 1.5 would be about here, 2 would be about here, and 2.5 would be here. So this here would represent my sampling distribution of the sample mean.

All right, so now let's take a look at some properties of the sampling distribution of sample means. These properties will hold for any sampling distribution of sample means. The one I created was very simple, but we'll see if these two things will apply to that distribution.

So specifically, we're going to look at the center and the shape-- two important things to consider when describing a distribution. So the center-- and we're going to measure the center using the mean. So the mean of the sampling distribution of sample means is the same as the population mean. The symbol for the mean of the sampling distribution of sample means is mu sub x bar.

And now we're going to say that's the same as the population mean. So that equals mu. So mu sub x bar equals mu. The expected sample mean equals the population mean.

Now what this doesn't mean is that each sample mean will be the same as the population mean. Notice this doesn't say x bar equals mu. It says mu sub x bar equals mu. So this statement will describe the center of the sampling distribution of sample means.

Now if we consider the shape, the shape, a lot of times, what we can use is a theorem called the central limit theorem. So the central limit theorem says that the sampling distribution of sample means will be approximately normal if the population distribution has a finite mean in standard deviation-- so finite mean, finite standard deviation-- and the sample size is sufficiently large, generally 30 or more. So as long as we have a finite mean, a finite standard deviation, and a sufficiently large sample size, we're going to get an approximately normal sampling distribution of sample means.

In that last case, we didn't have a normal distribution because our sample size was so small-- only n equals 2. But if you take a bigger sample size and you have a finite mean and standard deviation, you will get an approximately normal distribution.

All right, so there were a few properties of your sampling distribution of sample means. All right, so this has been your tutorial of sample statistics and population parameters. Thanks for watching.